

Getting Started

Arrakis Systems inc.

application note



Purpose of this Ap Note

This application note is designed as a practical aid for designing, installing, and debugging low noise, high performance audio broadcast studios and facilities. It is intended for use by novice and experienced “technical” people alike, including managers.

The application note focuses on the basic principles of audio “systems” design. Simple mathematical models are used only as they illustrate a principle. We find that it is the proper understanding and application of basic principles that results in a professional audio installation. It is often only through an application of basic principles that a problematic installation can be corrected.

In preparation for writing this application note, we have performed an extensive review of available technical literature and product manuals on these subjects. The review underlined the complexity of modern audio systems design and that this is a field under constant change. Combining audio products from the broadcast, consumer, music, commercial sound, and now personal computer industries into a single facility is a challenge. These different industries have different product design goals that have resulted in an inability to simply “plug and play.” It would be thought that it would be possible to simply purchase equipment and off the shelf interconnection cables to assemble an audio facility. However, variations in audio levels, impedance, connector designs, AC and audio ground systems, and other factors make this difficult. The purpose of this application note is to help to provide enough of an understanding of the underlying principles to be able to overcome these obstacles.

Arrakis Systems has been building professional radio consoles since the late 1970's and digital audio source equipment since the early 1990's. We are a leading manufacturer and innovator in the professional broadcast audio industry. We have accumulated experience with thousands of studios in diverse conditions around the world.



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Danger- Shock & other hazards

Electronic products may contain potentially lethal voltages and currents and should be serviced by trained and experienced personnel only. Any installation, test, or calibration procedures in this document that require access to the interior of the equipment should be performed by qualified personnel only.

How to Contact Arrakis

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2.0 Important Considerations

a) AUDIO BROADCAST FACILITIES HAVE UNIQUE REQUIREMENTS

Audio broadcast facilities generally have multiple studios with large numbers and varieties of audio sources. Each studio takes the audio from one or more source devices or network feeds, selects and mixes this audio, and then outputs the mix as either a real time (live) audio stream or records the mix for delayed use. These functional requirements are quite different from other types of audio systems and dictate many of the technical requirements for a broadcast audio facility.

b) AUDIO PERFORMANCE GOALS IN A BROADCAST FACILITY

In designing an audio broadcast studio or multi-studio facility the goal is to achieve consistent, high quality sound without extraneous audio artifacts.

Areas of importance are:

- 1) Consistent audio levels (repeatable performance throughout the facility)
- 2) 20Hz - 20kHz response and Low Audio Distortion (clear sound)
- 3) Inaudible background noise (hiss)
- 4) Inaudible 60 cycle noise (hum & buzz)
- 5) Inaudible transients (pops and clicks)
- 6) Inaudible RF interference (RFI) from external radio frequency sources
- 7) Inaudible crosstalk between circuits

c) THE IMPORTANT STUDIO SYSTEMS TO CONSIDER

There are many elements that contribute to the sound quality of a professional broadcast studio. A basic understanding of AC power systems, studio grounding systems, interconnection cabling, appropriate matching of equipment to application, and audio performance parameters are all important to building and maintaining a quality audio broadcast facility.

d) FACTORS IN BUILDING A NEW FACILITY

If you are building an audio broadcast facility from the ground up, it is relatively easy and inexpensive to install the best possible AC power distribution, facility ground, and studio ground systems. Taking a little time before a facility is built saves a great deal of time, effort, and money during the lifetime of the facility.

e) FACTORS IN ADDING TO AN EXISTING FACILITY

If you are retrofitting into an existing building or adding a new studio to an existing facility, you may be using AC and ground systems that are not designed for low noise audio applications. In many situations, audio performance may be entirely acceptable. In some cases however, the only way to achieve acceptable performance may be to upgrade your building to use the best possible AC and ground systems. In most cases, an upgrade to an existing building is not difficult or expensive. If it is decided to modify the AC ground system, be certain to use a licensed electrician and to have the building inspected by the appropriate local agency.

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2.1 Important Characteristics of an Audio Broadcast Studio

The block diagram illustrates some of the key functionality of an audio broadcast studio.

a) A BROADCAST STUDIO HAS MANY KINDS OF AUDIO EQUIPMENT

The functionality dictates many of the technical requirements for the studio and facility. Specifically, the studio must accept an extremely diverse mix of local and remote audio source equipment. This often includes consumer devices, broadcast source equipment, musical instruments, microphones, telephone systems, satellite receivers, and more. Also, the studio must interface with other studios, recording equipment, and sometimes the transmitter.

b) A STUDIO IS ONLY A SMALL PART OF THE LARGER FACILITY-WIDE AUDIO SYSTEM

The nature of most broadcast studios is that they are part of a “distributed” audio system. They are not small, stand alone studios. This means that there must be consideration given to the requirements of a distributed audio system. Examples are:

- (1) AC power distribution
- (2) Station and Studio grounding systems
- (3) Choice of equipment
- (4) Studio cabling
- (5) Other systems... PC network, telephone, satellite dish,...

